

Golden Eagle  
*Aquila chrysaetos*

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## GENERAL RANGE AND WASHINGTON DISTRIBUTION

Golden eagles are distributed throughout much of the northern hemisphere (Kochert et al. 2002). In Washington, golden eagles nest throughout much of the state, but are most common in the north-central highlands transitional area between montane and shrub-steppe habitats. Scattered nest sites are found in more arid portions of eastern Washington and west of the Cascades where the species is uncommon (Larrison and Sonnenberg 1968). The migratory status of nesting golden eagles in Washington has not been studied; observations of golden eagles along the upper Columbia River suggest they remain at nest sites throughout the winter (Knight et al. 1979).



General range of the golden eagle, *Aquila chrysaetos* (shaded areas) in Washington. Map derived from Washington Department of Fish and Wildlife Heritage data files and GAP Analysis of Washington.

## RATIONALE

The golden eagle is a State Candidate species. This species is vulnerable to population declines due to habitat loss and disturbance, loss of foraging areas, and through direct human-caused mortality (Franson et al. 1995, Kochert et al. 2002).

## HABITAT REQUIREMENTS

Golden eagles are commonly associated with open, arid plateaus deeply cut by streams and canyons, western shrub-steppe and grassland communities and transition zones between shrub, grassland and forested habitat (De Smet 1987, Marzluff et al. 1997). Nests generally are located on cliffs and are occasionally located in trees (Anderson and Bruce 1980, Menkens and Anderson 1987, Kochert et al. 2002). Golden eagles use the same territory annually but may use alternate nests in different years. This species uses an average of 2-3 alternate nests (range: 1-14 alternate nests) (Snow 1973). Individual eagles mature and may establish territories and breed during their fifth summer but are capable of breeding earlier in life (Kochert et al. 2002).

Although they are more common east of the Cascades, golden eagles are sometimes found in mature and old-growth forests near the edges of clearcuts in western Washington (Anderson and Bruce 1980). Golden eagle nesting was observed in the San Juan Island archipelago (<10 pairs) during the 1970s and 1980s (Washington State Wildlife Heritage Database). Bruce et al. (1982) found that golden eagle tree nests in western Washington were generally smaller than bald eagle nests, were placed at or below canopy height, and were located no more than 500 m (1,600 ft) from large clearcuts (<10 years old) or open fields. In another study, bald eagle nests were located at or above the canopy on the interior of a stand and were closer to water than golden eagle nests (Anderson and Bruce 1980).

Shrub-steppe and native grassland communities provide important foraging habitat for the golden eagle (Marzluff et al. 1997, Kochert et al. 2002). Small to medium-sized mammals such as hares (*Lepus* spp.), ground squirrels (*Citellus* spp.), marmots (*Marmota* spp.), mountain beaver (*Aplodontia rufa*) and birds (e.g., pheasant, grouse) are important prey for golden eagles (McGahan 1967, Olendorff 1976, Bruce et al. 1982, Steenhof and Kochert 1988, Marzluff et al. 1997). Based on a survey of prey remains at 74 nests in eastern Washington, yellow-bellied marmots were the most important prey of nesting golden eagles, whereas carrion was regularly consumed in fall and winter (Marr and Knight 1983). Golden eagles nesting on large cliffs in the Columbia Basin commonly capture rock doves (*Columba livia*) that roost on canyon walls (J. Watson, personal observation). Jackrabbits and ground squirrels were historically more abundant in the Northwest (Richardson et al. 2001, Yensen and Sherman 2003) and likely were a more significant source of prey for the golden eagle. Extensive poisoning of ground squirrels in the 1980s, and possibly other factors (S. Zender, personal communication), significantly reduced Townsend's (*Citellus townsendi*) and Washington ground squirrel (*Citellus washingtoni*) populations in Washington (Washington State Wildlife Heritage Database) to the degree that they are being reviewed for status listing. Several researchers (Bates and Moretti 1994, Steenhof et al.

1997, McIntyre 2002) have found increased productivity in golden eagles in years with a higher abundance of hare. McIntyre (2002) and Steenhof et al. (1997) found that golden eagle reproduction was related to prey abundance, with more pairs producing eggs and increased numbers of young fledged when prey numbers were higher. Some eagles conserve energy by suspending their breeding activity when food supplies decrease (Steenhof et al. 1997, McIntyre 2002).

Densities of golden eagles in the western states range from one pair per 34 km<sup>2</sup> to 251 km<sup>2</sup> (13-96 mi<sup>2</sup>) (Phillips et al. 1984). In Wyoming, prime golden eagle habitat as defined by high population densities consisted of a mixture of cliffs and trees suitable for nesting and open habitat with abundant and diverse prey (Phillips et al. 1984). Home range size, size of core areas, and travel distances can vary dramatically based on habitat composition, potential prey abundance and individual preferences (Marzluff et al. 1997).

## LIMITING FACTORS

Golden eagle populations appear to be limited by habitat availability and disturbance, adequate prey populations (e.g., large rodents, rabbits and hares), and the availability of undisturbed nest sites (Olendorff and Stoddard 1974, Beecham and Kochert 1975, Kochert and Steenhof 2002). Direct mortality is increased by poisoning from lead and other contaminants, power line electrocutions, collision with wind turbines, and shooting (Phillips 1986, Harlow and Bloom 1989, Craig et al. 1990, Wingfield 1991, Leptich 1994, Avian Power Line Interaction Committee 1996, Hunt et al. 1997, Hoover 2002). Breeding success is limited by reduced habitat availability and decreased prey populations resulting from habitat conversion (Murphy 1977).

## MANAGEMENT RECOMMENDATIONS

Factors affecting golden eagle habitat and populations have not been extensively studied in Washington, but studies have been conducted throughout western North America, and the following reflect the findings of these studies. These recommendations generally apply to conditions east of the Cascade Range because very few North American studies have been conducted in high rainfall zones.

In general, golden eagle habitat should be managed to improve native vegetation and maintain native prey populations (e.g., jackrabbits, ground squirrels) (Andersen 1991). Management of grassland habitats can influence prey density, diversity and availability (Andersen 1991). In general, certain prey species decrease with reduced herbaceous cover and foliage height diversity (Kochert 1989). Prey such as jackrabbits and ground squirrels, are believed to be moderately tolerant to grazing but they disappear where habitat is overgrazed (i.e., repeated grazing that exceeds the recovery capacity of the vegetation and creates or perpetuates a deteriorated plant community). Severely damaged native grassland can be restored by removing livestock, using controlled burning or chaining to remove trees and invasive shrubs, and reseeded with native

grasses (Kochert 1989). However, fire management should be conducted only after developing a professional fire management plan (see Washington State University Cooperative Extension Service in Appendix A), especially in low rainfall zones, where exotic vegetation (e.g., Cheatgrass [*bromus tectorum*]) often becomes dominant (Knick and Rotenberry 1995).

Burning and other techniques that reduce shrub stand density should be avoided in healthy shrub-steppe communities, such as those dominated by sagebrush, in order to maintain existing prey populations (Kochert et al. 1999, Kochert et al. 2002).

Few studies have documented the effects of habitat fragmentation on raptors. However, in several states, raptors survived only on large habitat patches (Robinson 1991). In arid regions, golden eagles require large expanses of undisturbed shrub habitat (Marzluff et al. 1997). Therefore, it is recommended that shrub stands be preserved within 3 km (1.9 mi) of golden eagle nests (Kochert et al. 1999). This distance accounted for 95% of eagle movements measured during the breeding season in western Idaho (Marzluff et al. 1997). Large-scale conversion of eagle foraging habitat should be avoided because it reduces prey abundance and availability. This is particularly important where prey are concentrated, such as at ground squirrel colonies. Many types of development that remove vegetation from localized areas, including oil, gas, and geothermal exploitation; power line, pipeline and road construction; and the development of campgrounds and other facilities may result in loss of habitat for certain prey species (Suter and Jones 1981).

Although empirical evidence is limited, recreation and other human activities near nests appear to cause breeding failure (Kochert et al. 2002). Rock climbing as well as development activities on or near cliffs containing nests should be avoided (De Smet 1987). Avoiding these activities is especially important during the nesting period of 15 February to 15 July (Beebe 1974; R. Friesz, personal communication). The establishment of buffer zones surrounding nests, wide enough to include 90-95% of flushing distances, is generally an accepted technique to reduce disturbance to nesting raptors (Olendorff and Stoddart 1974, Suter and Jones 1981, Mersmann and Fraser 1990). Buffer widths may be adjusted on a case by case basis (with the assistance of a professional wildlife biologist), depending on factors that may influence a pairs' response to a particular disturbance, such as influence of terrain on the "line of sight" distance, security of the nest, history of disturbance, and elevation of the disturbance relative to the nest (Suter and Jones 1981; K. Steenhof, personal communication).

Holmes et al. (1993) found that wintering golden eagles are more likely to flush when approached by a human on foot than by a vehicle. They suggested that a buffer zone of 300 m (980 ft) would prevent flushing by 90% of eagles.

Golden eagles often have wing spans that are greater than the distances between conductive materials on power poles, which increases their probability of electrocution (Harness and Wilson 2001). Power lines and poles in any nesting or feeding area should be constructed so birds cannot make simultaneous contact between any two items of conductive equipment. Once an electrocution problem is identified on any existing structures, utility managers should ensure these are quickly retrofitted or modified to eliminate bird loss (Avian Power Line Interaction Committee 1996,

Harness and Wilson 2001). Because multiple-phase transformers are believed to be associated with a disproportionate number of eagle electrocutions (Harness and Wilson 2001), the construction of this form of transformer should be avoided.

Rabbits and ground squirrels are important prey for golden eagles and have been targeted in control efforts. Rodent control should not occur within eagle foraging areas because it reduces the prey base (Eaton 1976, Phillips 1986, Young 1989). Shooting and rodenticides should be replaced by wildlife repellents for use in agricultural damage control. Two very effective jackrabbit/hare repellents available are trinitrobenzene-aniline (TNB-A), and zinc tetramethyl thiuram disulfide (TMTD) (Besser and Welch 1959). Another effective jackrabbit/hare repellent for use in orchards consists of a rosin and ethyl alcohol mixture (Cardinell 1958).

Because ground squirrels are an important prey of golden eagles (Kochert et al. 2002), spray application of pesticides near squirrel colonies should be avoided. If pesticides are to be sprayed, an additional buffer area should be used to prevent drift into the protected area. Droplet size, volume of compound and meteorological conditions should be factored into the buffer width (Kingsbury 1975, Brown 1978, Payne et al. 1988). Payne et al. (1988) describes a method for estimating buffer zone widths for pesticide application. In addition, pesticide use should be avoided during the ground squirrel breeding season, from early March to late May, and during the critical foraging time before estivation (dormancy period), mid-August through September (Carlson et al. 1980).

Organochlorine, organophosphate, and carbamate insecticides can be highly toxic to raptors and mammals, and their use in areas inhabited by golden eagles should be avoided (McEwen et al. 1972; Balcom 1983; Grue et al. 1983, 1986; Smith 1987; Hooper et al. 1989). If insecticides must be used, synthetic pyrethroid compounds may be an alternative. For example, permethrin is low in toxicity to raptors and mammals and bio-degrades rapidly (Grue et al. 1983, Smith and Stratton 1986). Repellents can be used with pesticides to deter golden eagle prey species from treated areas (Blus et al. 1989). If insecticide or herbicide use is planned for areas where this species occurs, review Appendix A for contacts to assist in assessing the use of chemicals and their alternatives.

From collection and clinical analysis of dead or dying golden eagles, toxic lead poisoning has been recently identified as a potential source of adult golden eagle mortality in eastern Washington (J. Watson, personal observation). Craig et al. (1990) and Craig and Craig (1995) found elevated levels of lead in golden eagles in southern Idaho and believed this may be a more serious problem than previously thought. The source of contamination is under investigation. If bullet fragments and lead shot prove to be the source of contamination, hunter removal of carcasses and gut piles from the field, or conversion to the now widely available and ballistically comparable non-toxic ammunition (e.g., tungsten-alloy shot, solid copper bullets) might substantially reduce lead exposure (G. Hunt, personal communication).

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## KEY POINTS

### Habitat Requirements

- Commonly associated with open, arid plateaus deeply cut by streams and canyons, western shrub-steppe and grassland communities and transition zones between shrub, grassland and forested habitat. Nests usually located on cliffs and trees.
- Use the same territory annually, but have an average of 2-3 alternative nests used in different years.
- Although yellow-bellied marmots are the most important prey of nesting golden eagles, jackrabbits and ground squirrels were probably the most significant historical prey for eagles in the Northwest.
- Carrion is important prey during the fall and winter.
- Home range size, size of core areas, and travel distances can vary dramatically based on habitat composition, potential prey abundance, and individual preferences.

### Management Recommendations

- Manage golden eagle habitat to improve native vegetation and maintain native prey populations
- Restore severely damaged grassland (e.g., non-shrub) habitat with controlled burning or chaining of trees and invasive shrubs, followed by reseeding with native grasses.
- Preserve shrub-dominated habitat (i.e., sagebrush) within 3 km (1.9 mi) of golden eagle nests and avoid practices that remove shrub cover (i.e., chaining or burning).
- Avoid new development and human activities near nest sites (especially between 15 February and 15 July).
- Designate spatial buffer areas to protect nests and juvenile eagles.

- Construct or modify power lines and poles so birds cannot make simultaneous contact between any two items of conductive equipment and avoid construction of multiple-phase transformers.
- Avoid rodent control within eagle foraging areas.
- Avoid using organochlorine, organophosphate, and carbamate insecticides in eagle habitat and prey concentration areas.